End-to-end QoS control for Triple Play services in converged networks

Evolution of networks

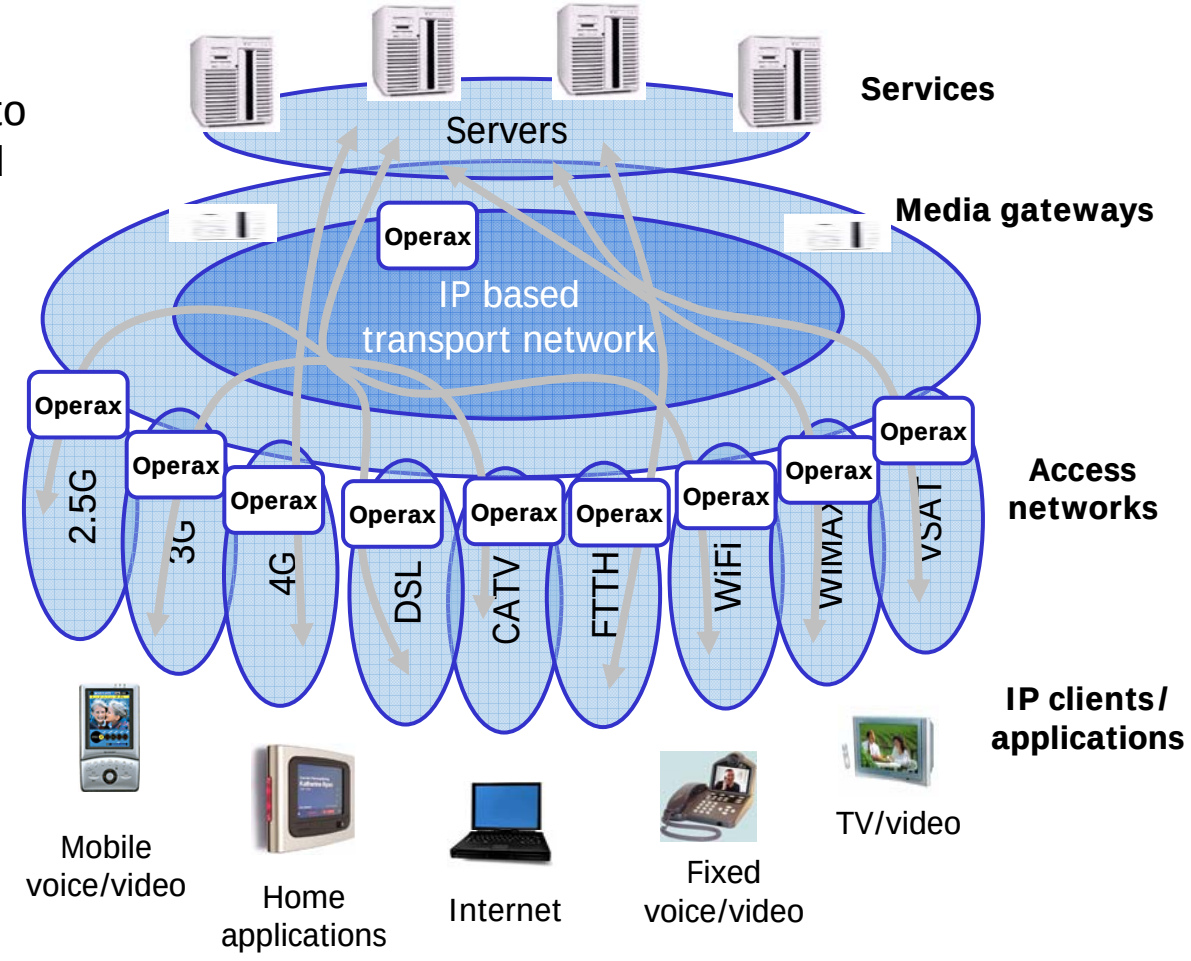
Operax solution

- Network resource control to guarantee QoS end-to-end
- Enables profitable multi-service IP networks

Operax vision

Guarantee QoS end-to-end:

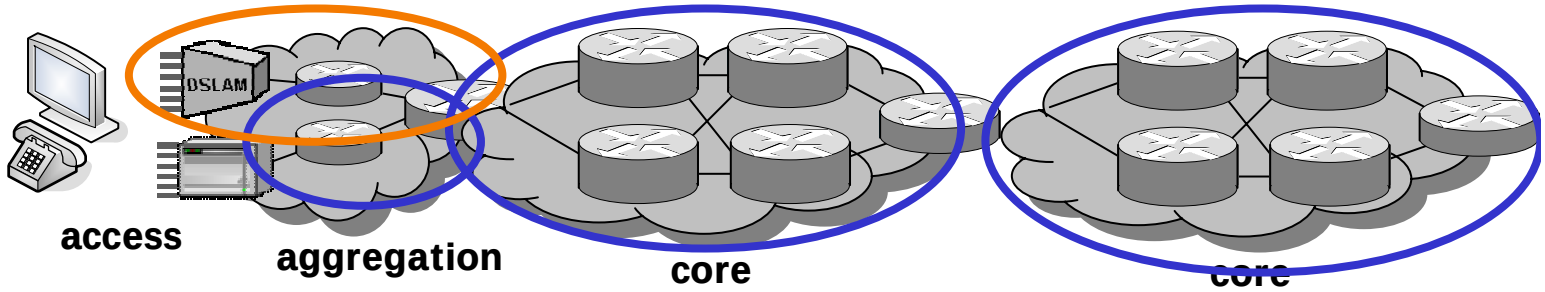
- multi-service,
- multi-technology,
- multi-vendor,
- in a cost efficient way!



Operax products and solutions

Operax Triple Play – Broadband VAS

Operax Bandwidth Manager – Multi-Service NGN



Network resource control concept

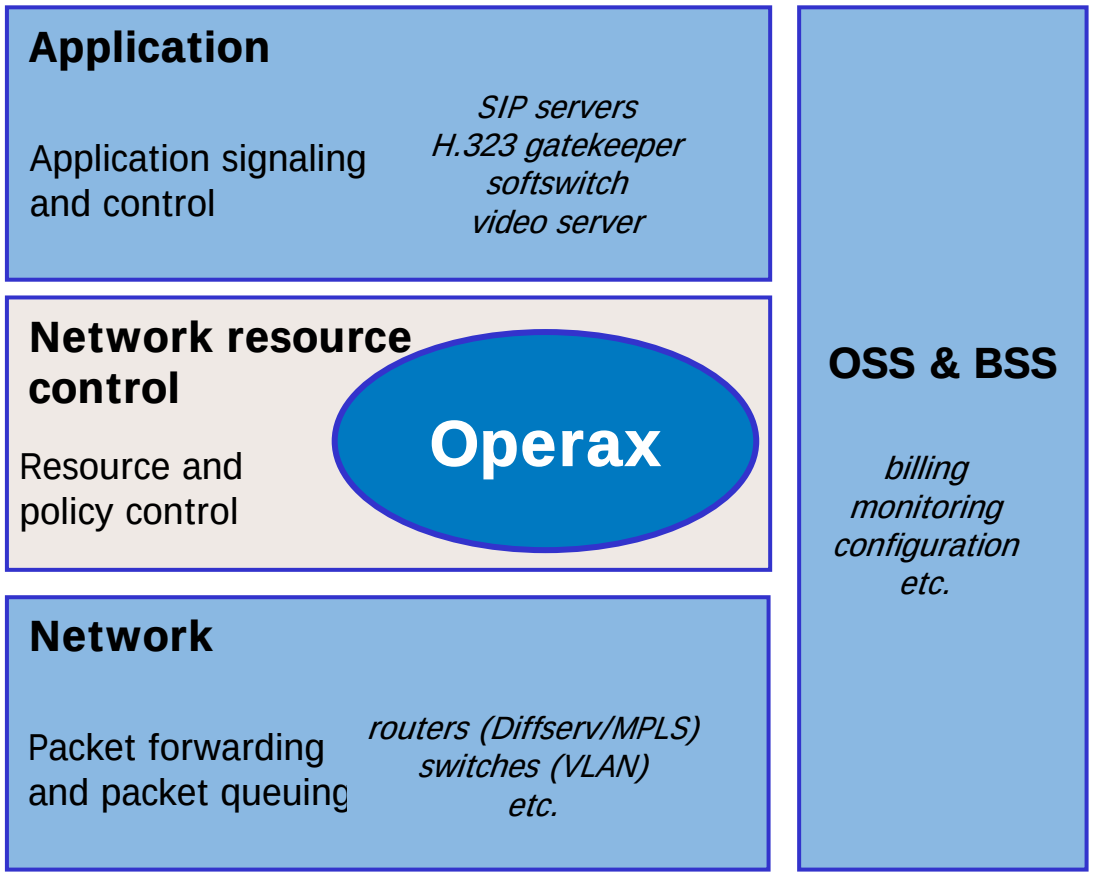
NRC solution for both access and core

Server based software solution (Linux, Solaris)

Real-time admission control (policy- and network resource based) for applications, user sessions and traffic aggregates

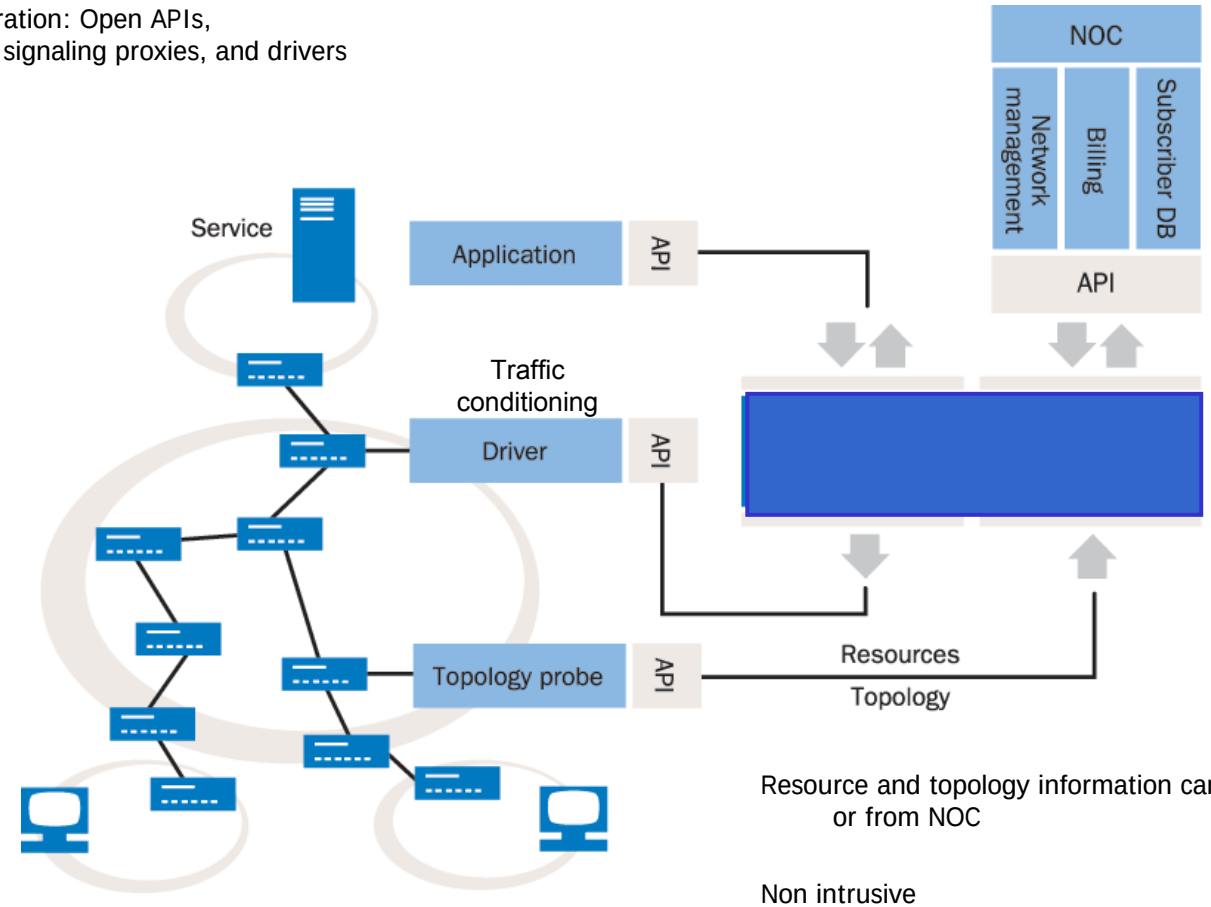
Complements traditional provisioning and management tools

Output CDR's and statistics to OSS



Operax NRC operation and integration

Integration: Open APIs,
signaling proxies, and drivers



Resource and topology information can be obtained through probing
or from NOC

Non intrusive

Operax Triple Play

Network Resource Control in Broadband Access Networks

- Policy Control
- Resource Control
- Layer 2/3
  - ATM
  - Ethernet
  - IP/MPLS

Network topology aware

Resource map in memory

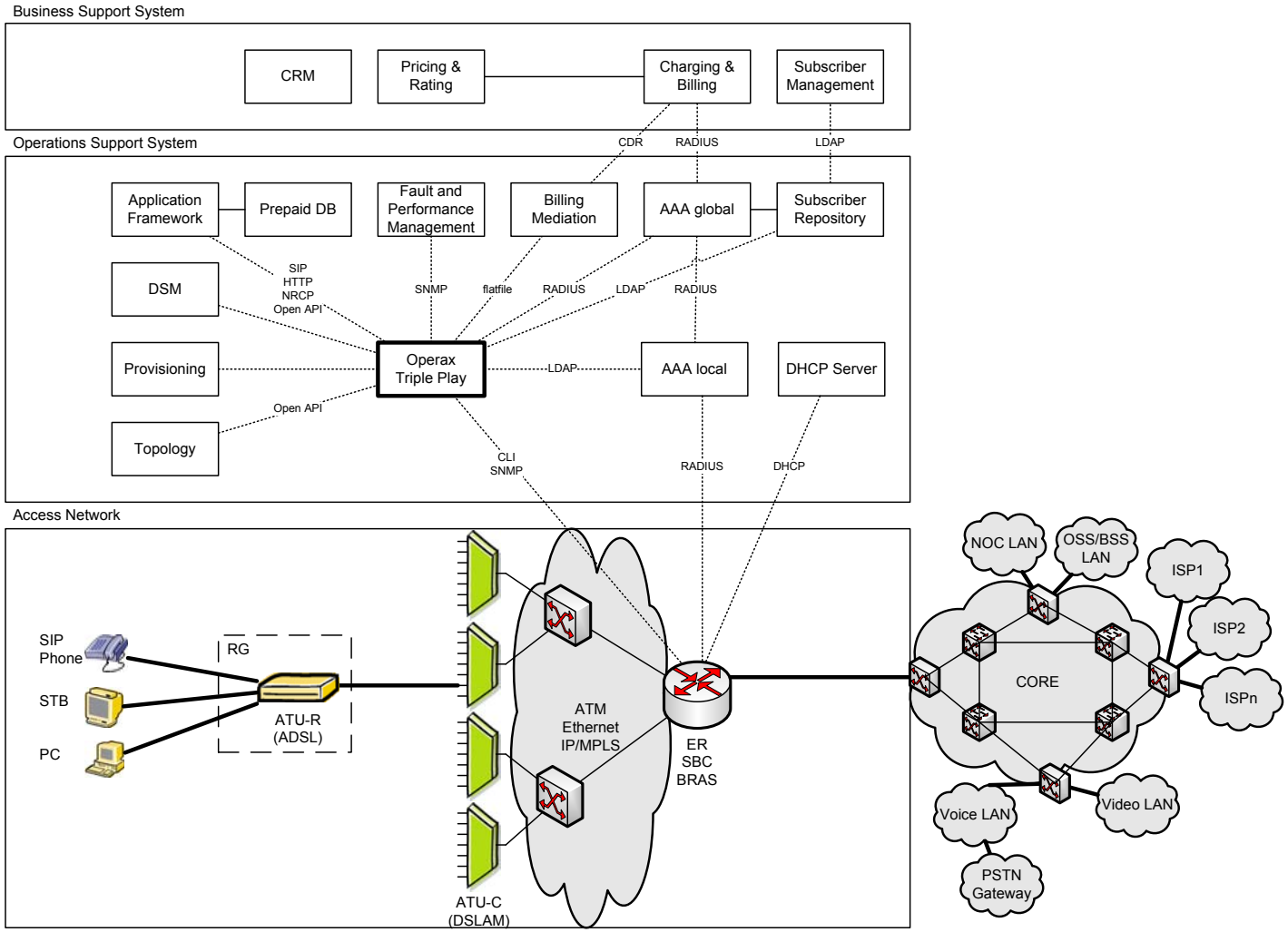
Northbound interface

- Resources requests forwarding from the network. Preferably via AF

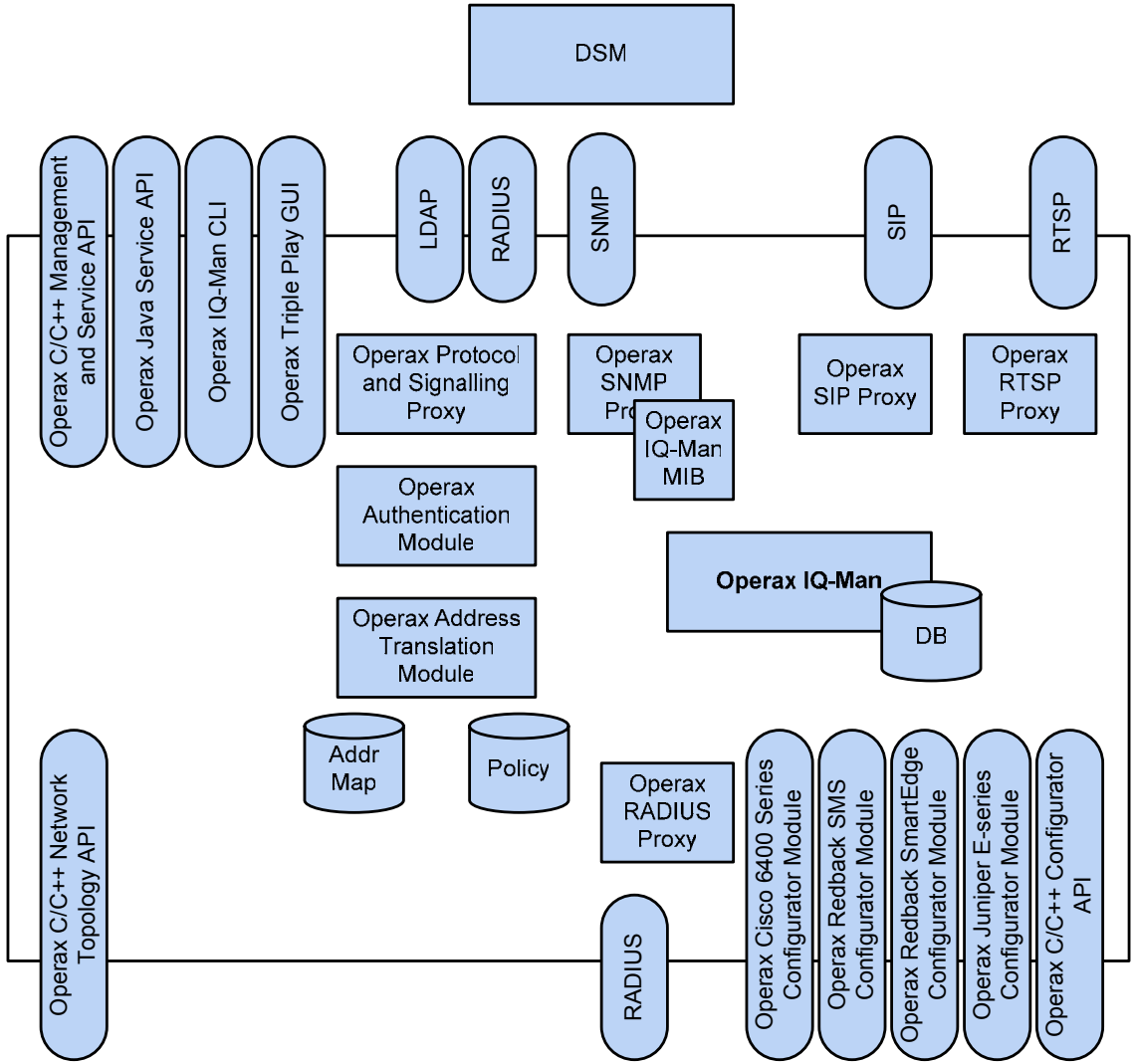
Path-sensitive admission control

- Resource requests evaluated at each link

Operax Triple Play
Product in target environment



Operax Triple Play
Product Architecture



Access network topology

Typically managed/inserted in Operax Triple Play

- by integration with OSS using the Network Topology API
- by using topology file

Layer 2 topology

- ATM topology + VC/VP
- Ethernet topology + VLAN
- etc.

Topology representation by using “virtual” IP addresses

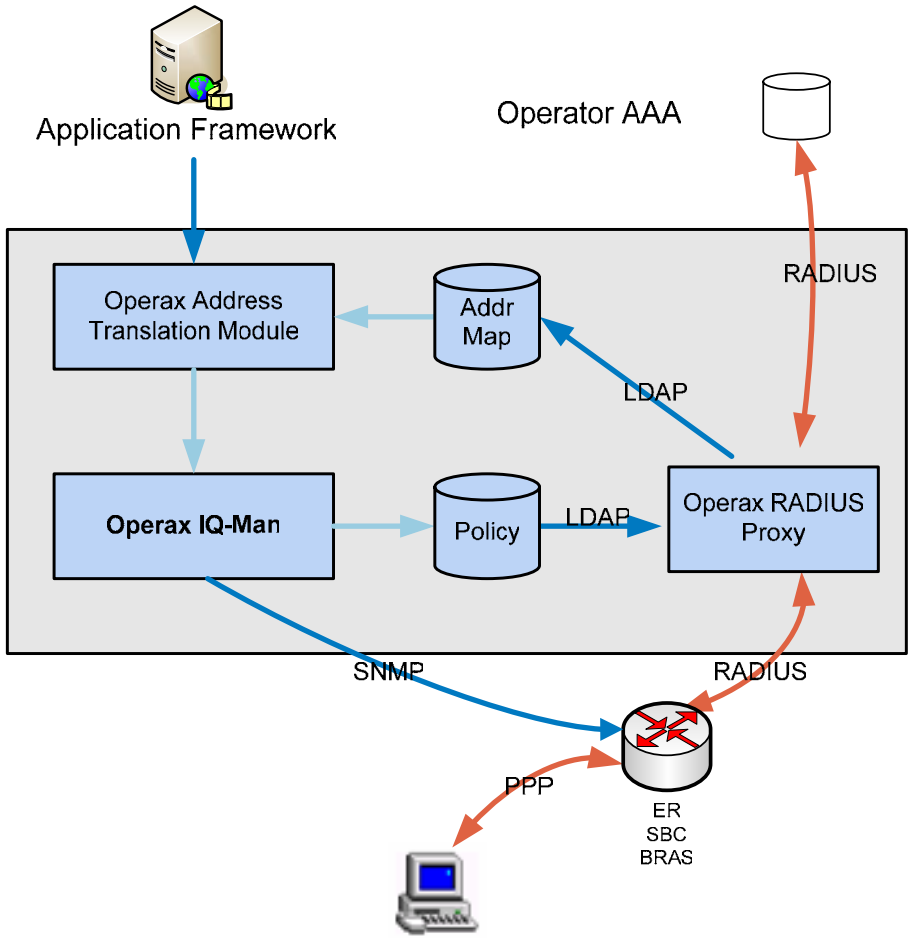
Operax Address Translation Module

Rewrite dynamic addresses to static physical addresses

Use LDAP database

- populated by RADIUS

Cache of IP addresses (expire after a configurable amount of time)



Application framework integration

NRCP, Network Resource Control Protocol

Bandwidth requests may be issued by application servers, call managers, other BMs, etc.

On protocol-level a long-lived secured connection is maintained

- streaming of request/replies possible

Hard or soft (time-limited) state for bandwidth reservations

NRCP, Basic bandwidth request

Requested rate (preferred and optional minimum)

Network service class (index)

- To be defined separately (e.g., conversational, streaming, interactive, background)

Source / ingress address (prefix)

- determines where the reservation starts

Destination address (prefix)

- determines where the reservation ends (The NRC can figure out the egress of its domain and ingress of next domain)

Optional Start / Stop time

- For advance reservations and soft state

Etc.

Custom integration via Open API

- VoD integration points
  - Middleware
  - RTSP Server
- VoIP integration points
  - SBC
  - SIP call server/agent
- Other AF enabling network forwarding resources to subscribers
  - Gaming portals

Operax SIP Proxy

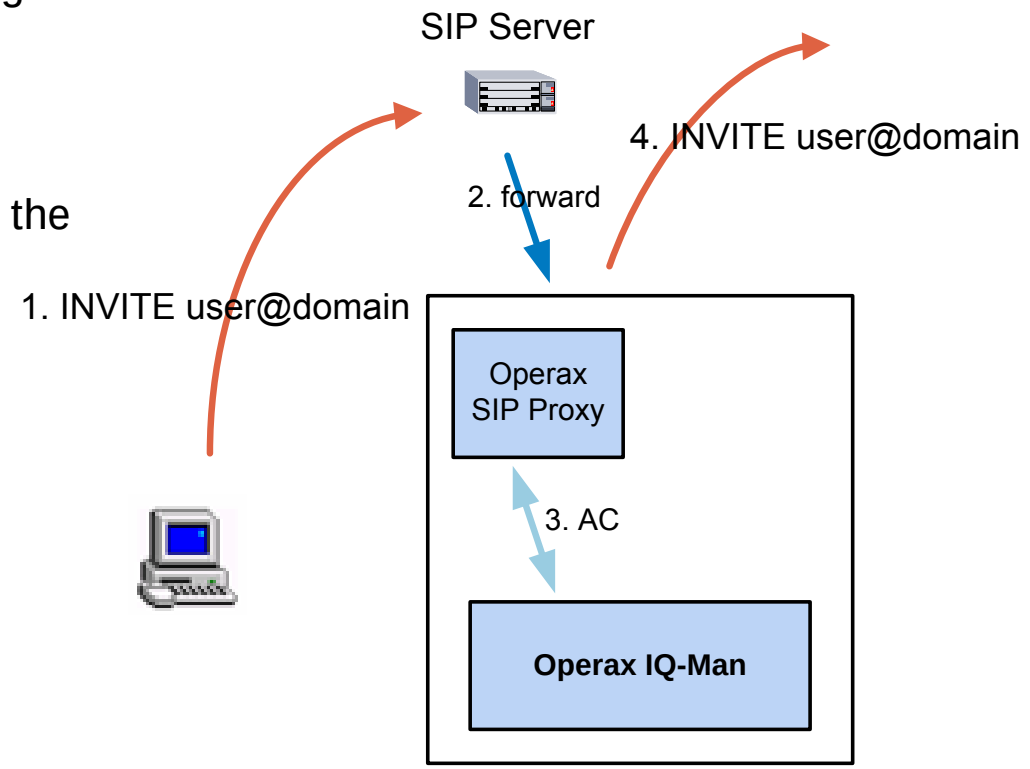
QoS for sessions established using SIP

Single- or two-phase setup

- Reserve
- Commit

Added in SIP signaling path after the main SIP Server

Reservation based on SDP



Operax RTSP Proxy

QoS handling, resource reservation

Hide media servers behind the RTSP proxy

- Available media servers are configured into RTSP Proxy

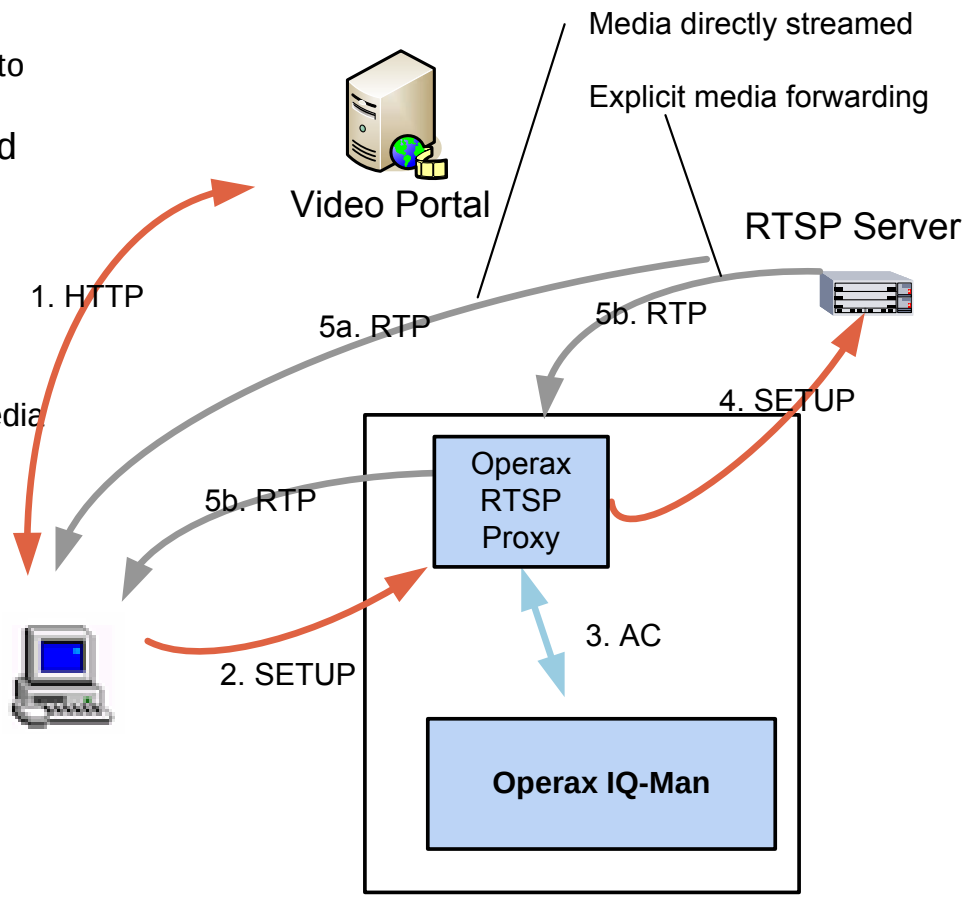
Intermediate unit between an RTSP client and an RTSP server

Modes of configuration

- Media directly streamed
- Explicit media forwarding

Load balancing

- Choosing one of a number of possible media servers



Traffic conditioning (policy enforcement)

Generic top-down traffic conditioning API

Packet filter

address ranges, port ranges, DSCP, protocol

Token bucket parameters

Marker

To be applied to edge routers, CPEs etc.

In line with ETSI/ITU/MSF

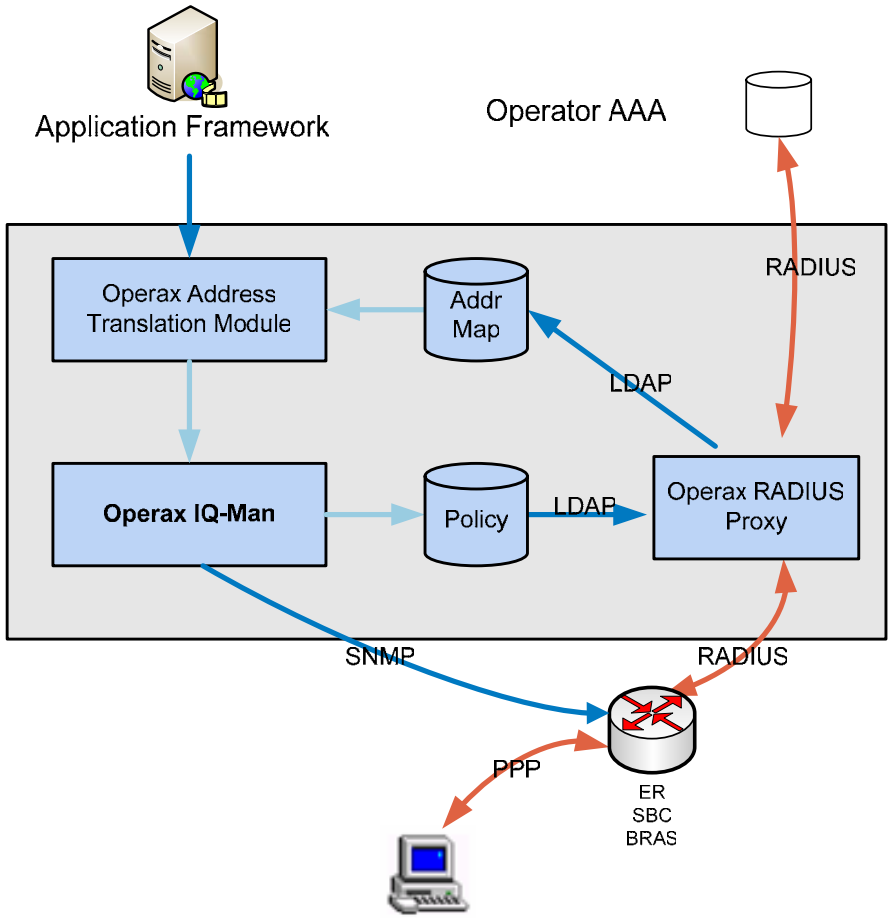
BRAS through Operax RADIUS Proxy

Operators choices:

- Operax RADIUS proxy
- Application Specific Module (ASM) installed in already deployed local AAA Proxy

Provides functionality to:

- Get IP to physical address mapping (RADIUS-ACCT)
- Populate RADIUS-AUTH messages (VSAs) and thereby updating the policy for the subscriber



Session Border controller

Combines session control and traffic conditioning

Session Control

SIP, RTSP,

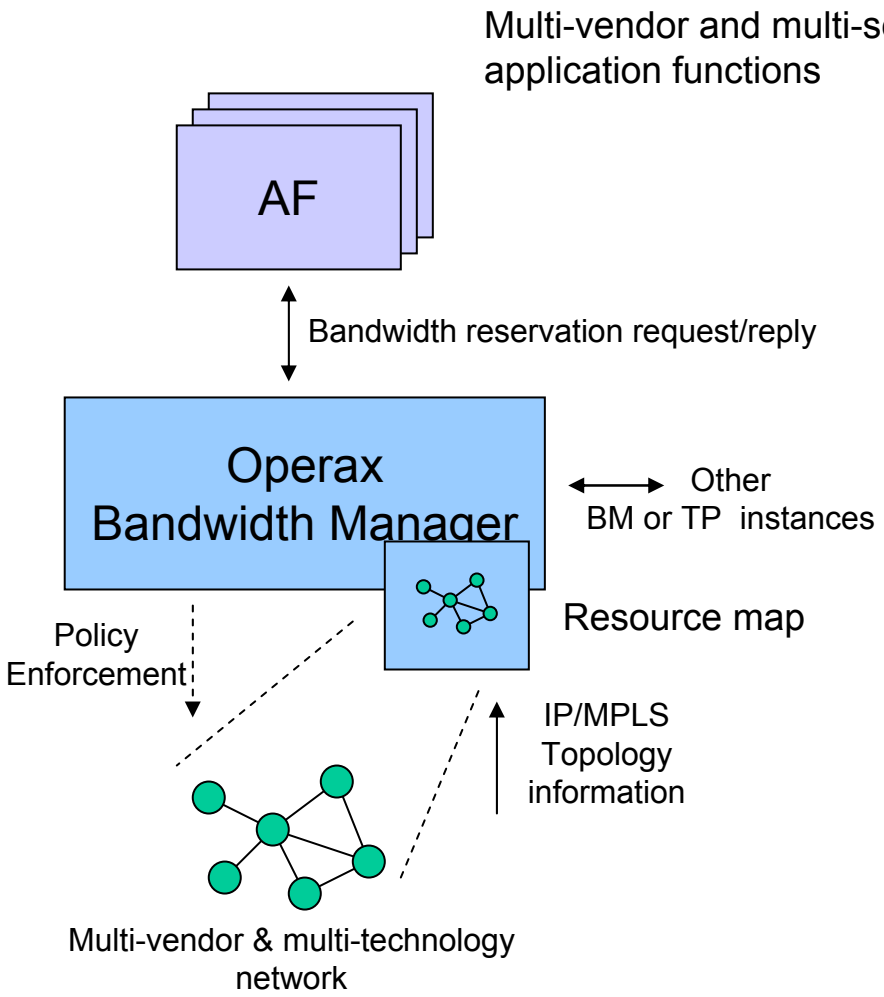
Outsourcing admission decision to NRC using NRCP

Activating traffic conditioning according to the response

OPERAX BANDWIDTH MANAGER

Doc nr. EXTERNAL-05:039

Operax Bandwidth Manager
A multi-service QoS control system



Unified control for any service

Application driven call and connection admission control

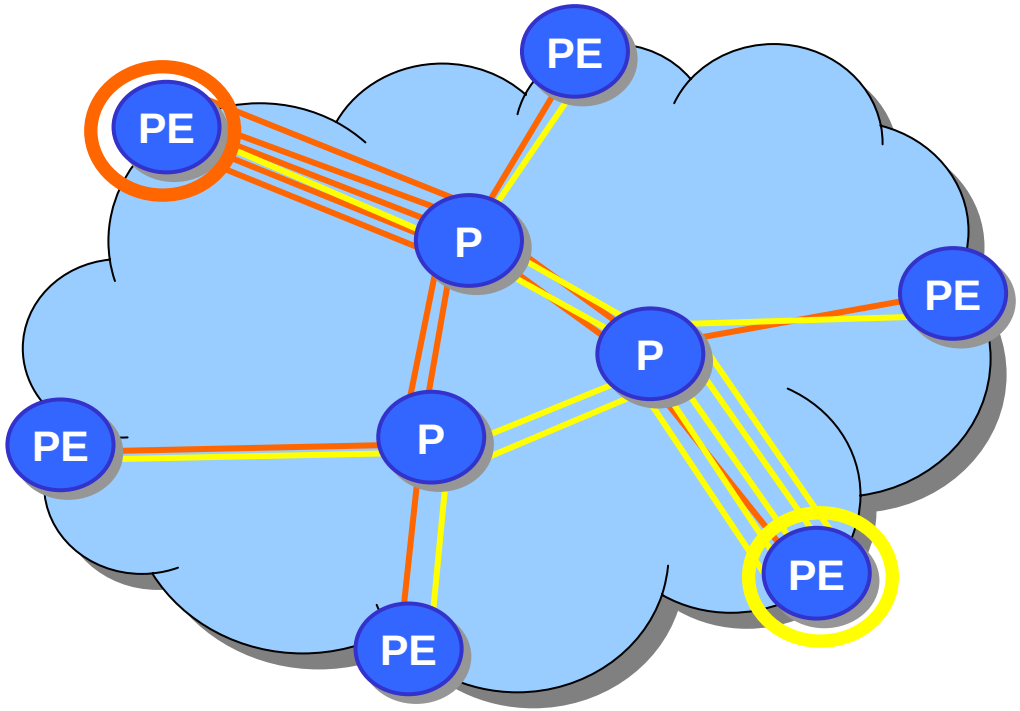
Fine-grained network modeling and admission control

QoS guarantee end-to-end (access, metro, core)

Open and standardized interfaces

Distributed & hierarchical solution provides carrier grade reliability and performance

Popular MPLS approach
Long thin pipes



- Edge to edge tunnels
- Explicit bandwidth allocations
- Full mesh
- *Long thin pipes - tunnel LSPs*
- N * (N – 1) LSPs

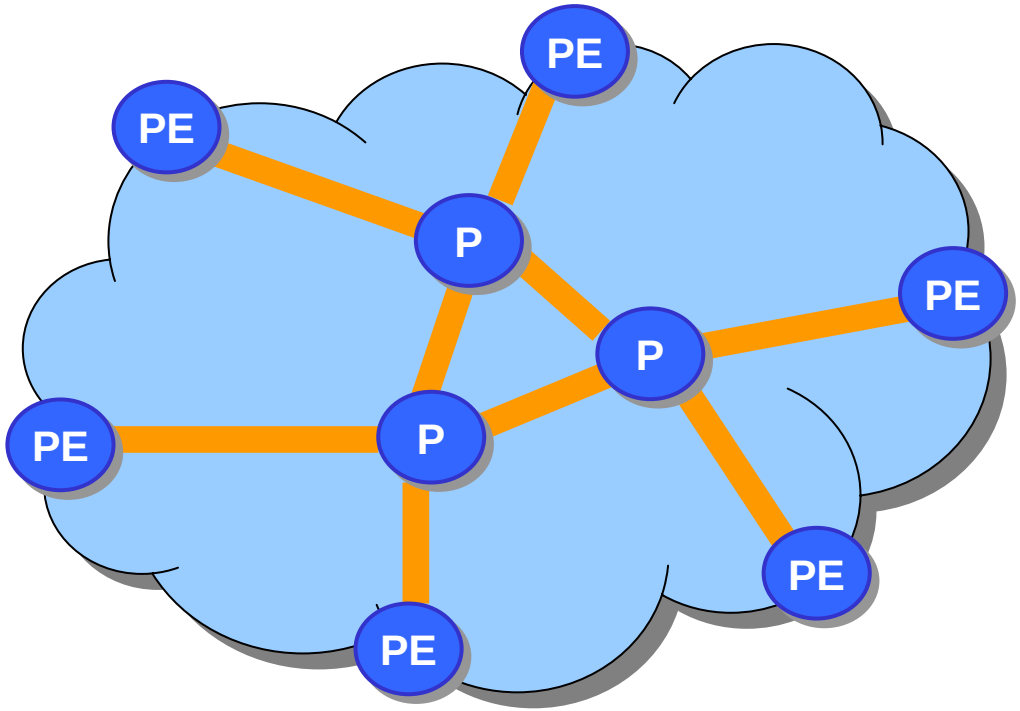
Example case *(N=100)*

- 100 * (100 – 1) = 9 900 tunnel LSPs
- Single service
- Without protection

Volume of entities to manage and resource partitioning grows with

- Network size (to the power of 2)
- Number of services (linear)
- Protection (linear)

Ideal approach
Hop-by-hop admission control



- Class based forwarding in core
- k * N hops to manage

Example case
(N=100, k=5)
- 100 * 5 = 500 *interfaces*
- Multi-service
- Protection included

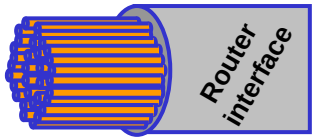
Volume of entities to manage grows with
- Network size (linear with "connectivity")

LSPs used only for addressing, separation and protection purposes through network. No static resource reservation per LSP.

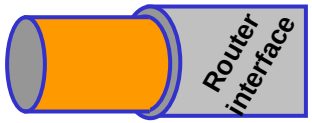
Planning, design and administration of MPLS pipes

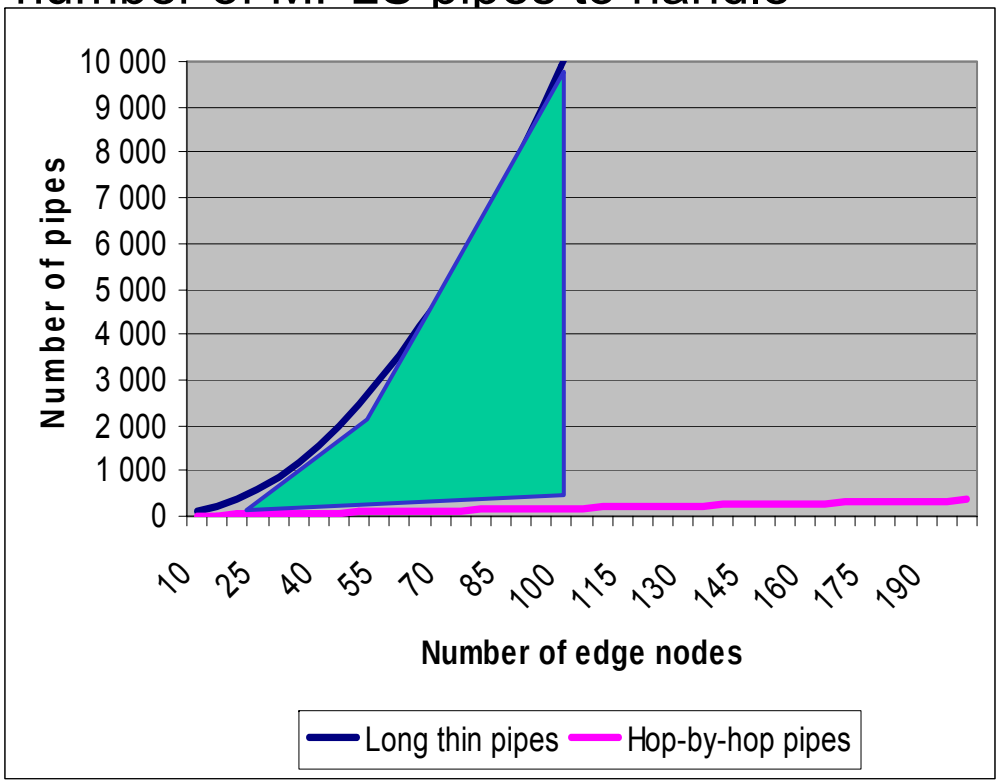
Work load is proportional to number of MPLS pipes to handle

➔ Long thin pipes grows quadratic with the number of edge nodes *n(n-1)*



➔ Hop-by-hop model grows linear with the number of edge nodes *n*





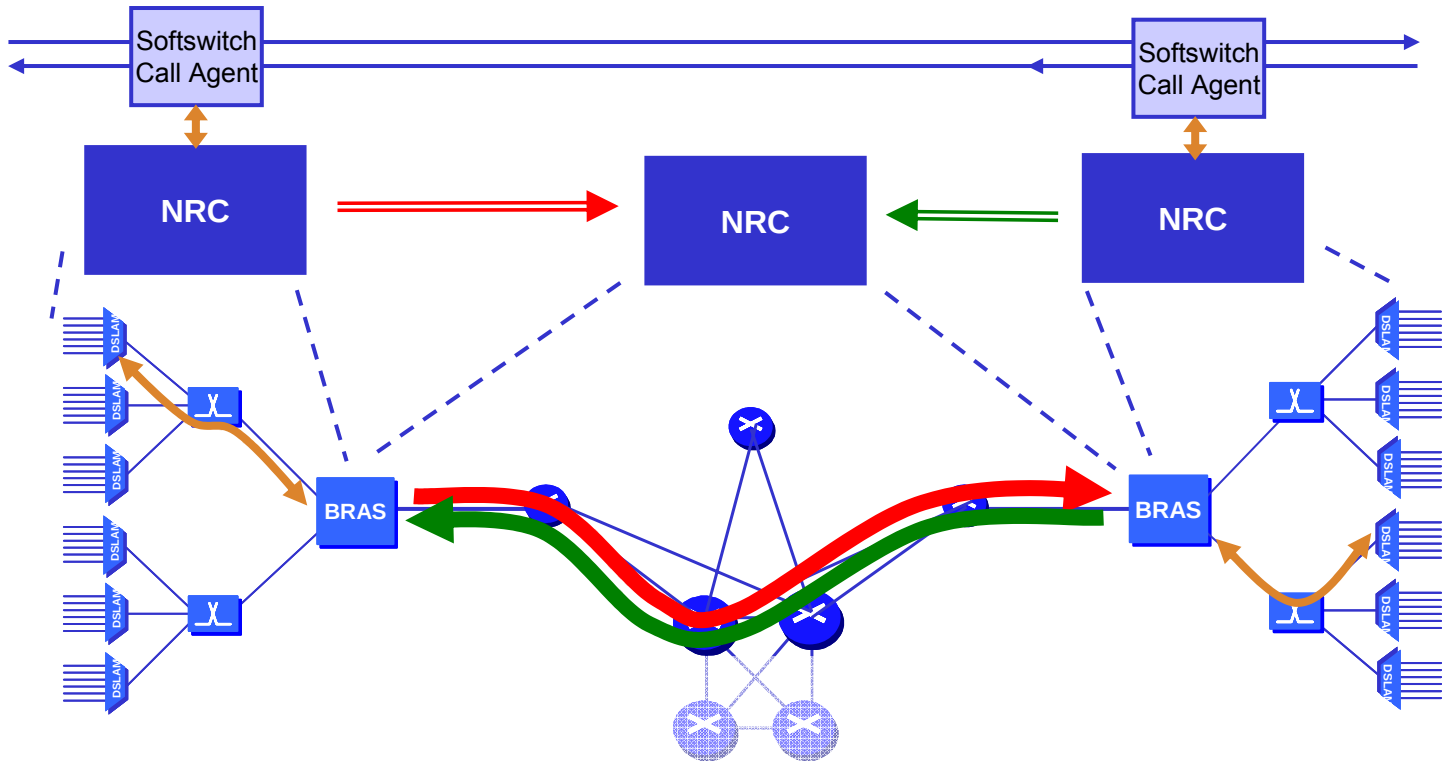
How big a network can the Operator handle?

End-to-end and inter-domain

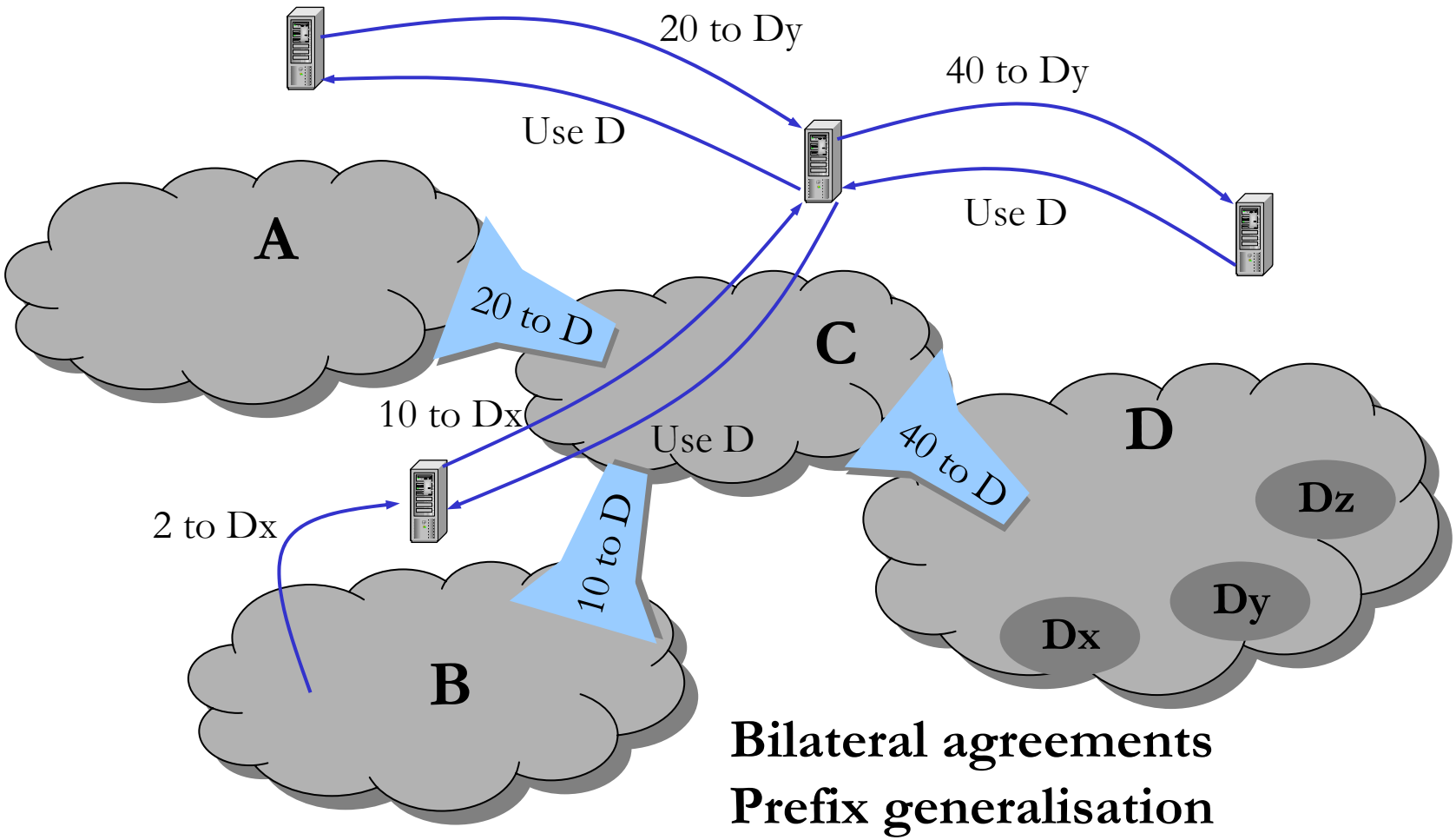
Scalability through aggregation

High performance CAC through dynamic resource subscriptions

- **Access NRCs** can dynamically subscribe to shared resources
- Shared backbone resources are managed by a **core NRC**
- Reservations for individual calls involve access NRCs only



Inter-domain core NRC and aggregation



Inter-domain operation

Peering relations between neighboring NRC instances are configured

- compare configuration of BGP peering

NRC participates in IBGP

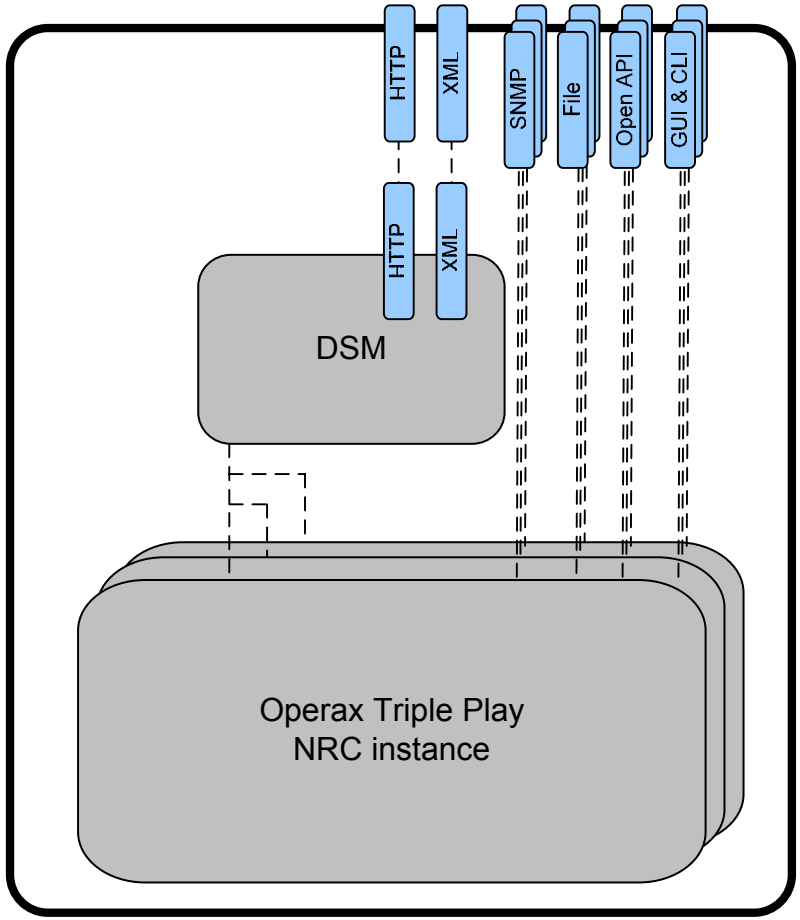
- to obtain the routes advertised by adjacent BGP domains
- To find the correct ingress point of adjacent domain for resource requests

BGP Policies

- NRC conforms to advertisements (that might be result of configured policies in routers)

Operation and Maintenance

Operation and Maintenance



ITU-T TMN

- FCAPS

Management Interfaces

- DSM GUI
- SNMP
- Flatfile
- Open API

Service Provisioning

Distributed System Manager (DSM)

Centralized installation, configuration and management of Operax systems

Integration with management systems via

- Web interface that supports
  - Basic administration task
  - Remote management and software configuration
  - Installations, upgrades, configurations and backups
  - Inventory reports and status information about the installations
- XML interface that supports
  - More advanced system-to-system integration tasks

Summary of values

New services and business models

- Speed to market (voice, video, data, etc)

Increased network efficiency

- Flexible cross-service resource sharing
- QoS across contention points

Increased operational efficiency

- Reduced MPLS provisioning
- Feedback to provisioning process

Reduced capital expenditures

- **Multi-vendor networks**

End-to-end QoS